The American Fertilizer

Vol. 96 APRIL 11, 1942 No. 8

Published every other Saturday. Annual subscription: In the United States, $3.00; Canada and Mexico, $4.00; other countries, $5.00. Entered as second-class matter, January 15, 1910, at the Post Office at Philadelphia, Pa., under Act of March 3, 1879. Registered in United States Patent Office. Publication office, 1330 Vine St., Phila., Pa.

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...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 96 APRIL 11, 1942 No. 8

Hidden Hunger and You

The Fertilizer Industry An Aid To Public Health

By CHESTER F. HOCKLEY

President, The Davison Chemical Corporation

Introductory

DANISH children suffered acutely from blindness during the first World War because Denmark exported its butter. Far-fetched, you say. No, not at all. A direct relation exists between butter and eyesight. Science tells us that when light strikes the retina, the nerves leading to it are stimulated by the chemical now known as vitamin A. No vitamin A in the body, no eyesight. Most of you know that vitamin A is derived from animal fats and oils, butter being one of the chief sources for many of us. In selling their butter abroad, the Danish farmers also sold away their children's eyesight. This recorded fact, among many, shows dramatically how potent can be the influence of the vitamins, not to mention the minerals and other nutrients of the food we eat, on our health and well-being.

Time was when grass was "just grass" and food bought for the table was selected by its appearance or price. Although this is still true to a large extent, it is rapidly changing. The government is now emphasizing the importance of better nutrition as a part of Civilian Defense. Our armed forces are better fed than at any time in the past. All countries at war recognize the role that nutritionally balanced diets play in morale and stamina. Vitamins are contraband and have been removed from enemy vessels on the high seas.

Today, the science of nutrition is being used to do a wonderful job of familiarizing the general public on how nutritional quality in foods influence health and stamina. We needed this information. So much misinformation about food in the past got many of us into the habit of discounting practically everything said about it. But now that the government and other dependable agencies have popularized the real facts, we are ready and willing to learn more about nutritional quality and "hidden hunger." Mr. Henry A. Wallace, when he was Secretary of Agriculture, called attention to the problem of malnutrition in our nation. The following passage is quoted from his statement:

"In ordinary diets, both animal and human, that contain a wide variety of natural foods, most of the essential substances are present in adequate quantities. But under certain conditions, when the choice of food is limited, the diets customarily followed cause inefficiency, sickness or even premature death. The lack of common-sense knowledge of nutrition even among many well-to-do people in the United States is appalling. There are many kinds of 'hidden hunger' which the experienced person can read in the faces and attitudes of the undernourished. Peaked faces, bowlegs, and shaky nervous systems are only a few of the manifestations."

Studies made by the U. S. Department of Agriculture reveal that more than one-third of our entire nation lives on a deficient diet. Some forty million persons in our country are not being nourished adequately to maintain good health. Many of these millions who suffer from deficient diet do not always show extreme symptoms of deficiency diseases such as rickets or scurvy or pellagra. Many of them, however, show the result of eating less nutritious food by such common ailments as indigestion, poor teeth, night blindness, chronic fatigue or nervous ailments which are grouped under the term "emotional instability."

The War Department has also contributed some startling information on malnutrition. The recent examination of draftees is the basis of its report. Of the first million young men examined for Selective Service, 400,000 were found physically unfit for military duty. Of this number, one-third had defects that are traceable to malnutrition.

This serious problem can and should be tackled in a large measure right at the source, namely, on the nation's farms. The government has established higher crop quotas. It is proper that we emphasize that yield is not enough. We must have much more food, of

Sharecropper's child suffering from rickets and malnutrition.

"How important it is to normal development and well-being to have in the diet a sufficient amount of calcium and phosphorus in suitable ratios, together with vitamin D."

course, but it should be food of high nutritional value.

It seems to me that of all the arts and sciences none is more directly important to us than the feeding of humans, animals and plants. We are, after all, what we eat. Food shapes our bodies and, through its complex action on our glands and nervous system, it dictates the mental and emotional make-up of each of us. We are what our soil is. All food is obtained directly or indirectly from the soil. Plants reflect the constituents of the soil in which they grow. Some soils are rich, others are poor, in certain plant food elements. Foodstuffs which grow in the natural state on such soils reveal these differences by fairly well-known deficiency symptoms, with nutritional quality varying correspondingly.

The soil, the atmosphere, plants, animals and man are bound together by a very close and complex relationship. The plant nourishes itself on minerals and water in the soil and some chemicals in the air, such as carbon dioxide. What the plant does not utilize in its own life processes, is stored as surplus. Man and animals in their turn consume this stored surplus as food, and what is not used up in their own vital needs, is excreted, to serve once more as raw food materials for plants. Thus the wheel of life rolls on—one cycle after another, all closely inter-related, one with the other.

With these thoughts as an introduction, I shall now discuss the subject:

Higher Yields? Yes! But Yield Alone is Not Enough

With the accumulation of knowledge in all branches of science, it became easier to realize how vastly complex is Nature. In order to intensify research into each new field of knowledge, it was necessary, at first, to departmentalize. Specialists developed, each intensively absorbed in his particular department. As one wit said: "The experts learned more and more about less and less." In the beginning the broader inter-relationships could hardly be appreciated. One could not see the forest because of the trees. That was inevitable in the progress of scientific research. However, sooner of later we were bound to realize that Nature is one great unity and the tremendous amount of separate knowledge accumulated by each branch of science would have to be integrated in order to discover the close inter-relationships which exist. Of these the one we are here concerned with particularly is that which links soil, plant, and animal with human health and happiness.

This is not an original thought with me. The same idea has been expressed by others. I do, however, believe it is necessary to emphasize it and drive it home, because only by so doing can we hope to win acceptance of the newer knowledge about the nutrition of plants and animals.

Recently I had the pleasure of reading through some chapters in a beautifully gotten-up book titled "Hunger Signs in Crops." This book deals with nutritional deficiency signs in crop-plants. The many illustrations in color show very strikingly what scientists now recognize as starvation signs in most of our staple crops. They make one realize how far plant food research has travelled. What pre-

viously was accepted as so many symptoms of "plant disease" is now acknowledged as signs that the plant is starving for certain specific plant food elements. As I said before, the crop merely reflects the composition of the soil; if certain elements vital to plant growth are not available in the root zone, the plant cannot obtain them and suffers accordingly. If the plant does not get these mineral elements, then we, depending on that crop plant, will not get them either. This book is a fine illustration of practical agricultural research in the service of human health.

These latest developments in nutrition give emphasis to the importance which certain minerals and vitamins and related factors exert on our well-being. They suggest we should change our viewpoints and objectives. In the

Typical owner-operated small farm in Georgia.

"In the last analysis, the problem of human and livestock nutrition resolves itself into a problem of improving the methods of crop production—that is, food production."

past, we have spent a lot of time, money and effort in finding out everything that could be done to increase the yield of crops. We succeeded well, I dare say. Production records speak eloquently of this achievement. However, while not sacrificing our ability to produce abundantly, we should give more consideration to quality. Let us by all means get maximum yields per acre, but at the same time, let us produce crops of maximum nutritional quality for animals and humans. In other words, our goal should be not merely to produce two blades of grass where only one grew before, but rather, one blade to do the work of two, and do that better.

You may say, that is all very well, but how are we going to do it? Well, let us examine some of the factors involved. First, we must have a clear conception of how the physical well-being of men is inter-related with the factors in the soil which influence the nutritional quality and development of plants. This information will permit us to point out the correctives and set new objectives. It was not so long ago we were interested in only the proteins, fats, carbohydrates and calories. Since then science has revealed many additional dietary factors—such as enzymes, hormones, vitamins, the common minerals like calcium and phosphorus, and the "trace" or "rare" elements like iron, copper and manganese. The nutritional significance of these factors is now fairly well understood even though research continues to make new and important contributions that enlarge our knowledge.

Minerals Needed by Plants and Animals

The good earth is truly Mother Earth. Plants depend on her for nourishment and growth; man and animals depend on the plants. The soil is mother of all life. Plants must get from the soil all the mineral elements needed. Calcium, phosphorus, potassium, sodium, magnesium, sulphur, iron, manganese, boron, copper and zinc are required; some only in minute quantities—boron, for instance. Too much might prove harmful. Animals and man require all these elements too, except perhaps boron; and in addition, they need chlorine, iodine, and a few others. Some investigators claim that plants require as many as 64 different chemical elements. However, be that as it may, we shall for the present confine ourselves to a consideration of those elements that by common consent are now known to be essential to the average normal growth of plants. Such elements seem to occur in sufficient amounts in many soils. Some of these elements are needed in relatively larger quantities than others. For example, plants need more calcium and phosphorus than iodine or cobalt. However, even when the element is needed in trace amounts, the plant must have it for its normal development. Lacking such trace element, the plant reveals the deficiency by certain tissue symptoms. Both layman and professional have up till recently looked upon such deficiency symptoms as diseases. For example, they spoke of "sand drown" disease in tobacco, which is now known to be caused by lack of magnesium in the soil; "pecan rosette" in the South due to deficiency of zinc; "cracked stem" of celery due to lack of boron; corkiness and "measles" in apples traced to boron insufficiency. These and many more deficiency symptoms are over-

(Continued on page 20)

High-grade Fertilizers are More Profitable*

By M. H. LOCKWOOD

Manager, Fertilizer Division, Eastern States Farmers' Exchange, Springfield, Massachusetts

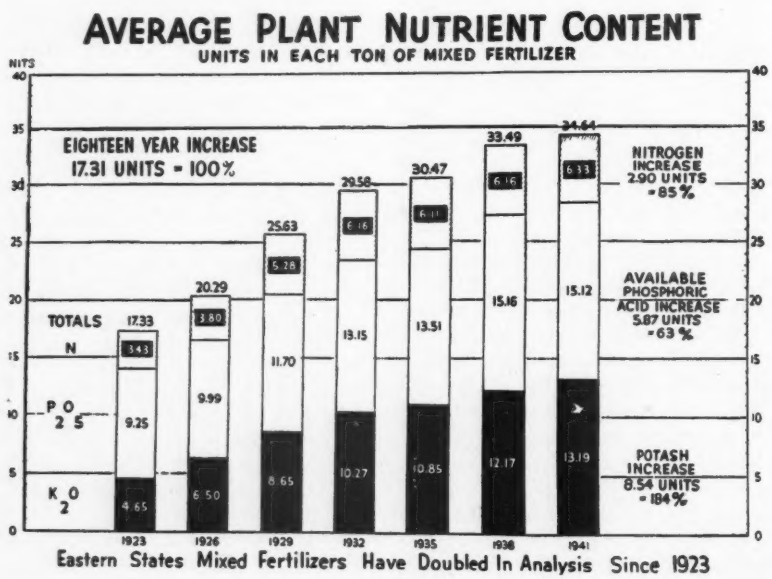
EIGHTEEN years is a long time, yet not too long in which to accomplish something worth-while. We state this because it took us from 1923, when our average mixed fertilizer contained 17.33 units of plant nutrients, until 1941 to double the average analysis of our mixed fertilizers. Actually our program of high analysis mixtures of the 40-unit type began in 1925, although there had been a definite trend upward before that year. Right now, however, most of us are interested in those practical things which we can do at once to contribute toward our nation's Victory Program.

The possibilities along this line in higher analysis fertilizers lie principally in increasing 15- and 20-unit mixtures to 20- and 25-unit grades. The savings thus made will be largely in the greater efficiency of package use, in manufacturing margins, and in distribution costs such as railroad freight. Users naturally question whether such higher analysis fertilizers are as satisfactory in terms of crop results. The answer is yes, as indicated by yields on thousands of farms. Equally satisfactory yields have proven the agronomic soundness of higher analysis fertilizers year after year.

If there were available plentiful supplies of high analysis materials, we might well go further in our present recommendation. The fact remains, however, that in both the phosphates and the nitrogen carriers, our supplies of high analysis materials are quite definitely limited. The changes we can make right now in our mixed fertilizer concentration are confined to those made practical by the gradual increase in analysis of the ingredients we use in making up some of the grades of mixed fertilizer of which our national tonnage is heavy.

The survey of fertilizer distribution for the year ending June 30, 1939, indicated that of the 12 leading grades in ton volume, only three had a plant nutrient content of 20 units. This indicates that we have a lot of room for improvement. With the present heavy demand on our

* Reprinted from "Better Crops with Plant Food," March, 1942.



transportation facilities and the urgency for conservation of packages and farm labor, we can see added reasons for doing without delay everything we can to take up the slack in any of our present customs. One of the ways we can do this in fertilizers is to increase 15- and 20-unit mixtures about five units in concentration. Such an increase would result in substantial savings in cost to the fertilizer user, in packages, manufacturing costs, and in transportation.

The relative savings in cost for increases in concentration are illustrated in Chart C, which shows that in a 1-2-2 ratio there are substantial savings in increasing the concentration from 15 units as in the 3-6-6 grade to 20 or 25 units as shown in the 4-8-8 and 5-10-10 grades.

The room with which to make these changes has been developed largely during the past 15 or 20 years by increases in the analysis of many fertilizer materials commonly used. In ordinary analysis superphosphate, for instance, 18% and 20% material are commonly produced now where 10 or 15 years ago the analysis of this material was usually two or more units lower. There are numerous other parallels that could be drawn, but we shall mention only one. In muriate of potash, for instance, 10 years or more ago, most of us were using a grade of this material analyzing 48 to 50% potash, but for several years now, the industry has been able to secure muriate of potash analyzing 60% or higher. In fact, we have, today, in our domestic potash distribution the uneconomic practice of refineries rediluting muriate of potash to make 50% material before shipping it across the continent largely because there is an insistent demand for 50% muriate of potash which the trade for so many years used when it was the highest analysis available.

Habits Must Be Changed

Probably the chief difficulty we in the fertilizer industry have to overcome is the mental hazard of "figures." It is human for us all to like something because we are accustomed to it. We become used to the grade numerals of a particular mixed fertilizer. We become used to a certain analysis of an item like superphosphate and muriate of potash and if we are not careful, we find ourselves in the awkward position of leaving our fertilizer grades too much like they used to be without taking into consideration the sound changes that could be made in them if we took advantage of the increases in analysis of the ingredients that go to make up those mixtures.

In order to get down to cases. I will cite an illustration in my own organization. In 1939, we resurveyed our position on grades and ratios in an effort to follow the suggestions of agronomists who were making a new set of recommendations. In this survey, we discovered that during the preceding 11 years, one of our leading ordinary analysis grades, the 4-8-8, had become somewhat out-of-date because of the advent of higher analysis ingredi-

(Continued on page 18)

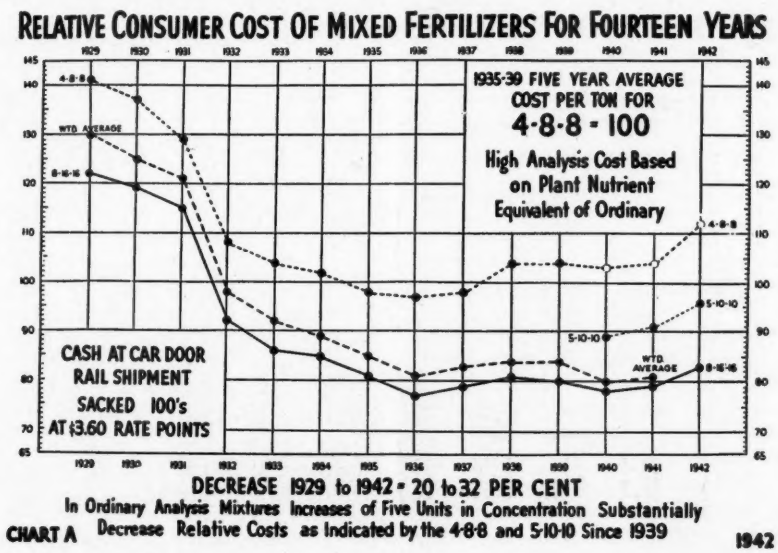


CHART A 1942

THE AMERICAN FERTILIZER
ESTABLISHED 1894
PUBLISHED EVERY OTHER SATURDAY BY
WARE BROS. COMPANY
1330 VINE STREET, PHILADELPHIA, PA.

A MAGAZINE INTERNATIONAL IN SCOPE AND CIRCULATION DEVOTED EXCLUSIVELY TO THE COMMERCIAL FERTILIZER INDUSTRY AND ITS ALLIED INDUSTRIES

PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

WARE BROS. COMPANY
PUBLISHERS
1330 VINE STREET PHILADELPHIA, PA.
A. A. WARE, EDITOR

ANNUAL SUBSCRIPTION RATES

U. S. and its possessions, also Cuba and Panama.....$3.00
Canada and Mexico 4.00
Other Foreign Countries 5.00
Single Copy ..... .25
Back Numbers ..... .50

Vol. 96 APRIL 11, 1942 No. 8

Principal Articles in This Issue

It Must Not Happen Again

While the termination of the fertilizer anti-trust suit through the entering of pleas of "nolo contendere" was the wisest and most patriotic step by the defending companies, in view of the need for maximum fertilizer production during the emergency, it is unfortunate that many points in dispute are still left as vague and undecided as they have been during the three years since the fertilizer investigation began.

In comments made after the taking of evidence was completed, Judge Hayes said that "the defendants at least have my sympathy in one regard. When they go away from this Court they won't know how to behave themselves in the future: and I go away myself feeling somewhat dissatisfied because I don't know as much about it as I would like to know. If I were the attorney for these companies I don't know that I would feel safe in advising them how to travel in the future so as to avoid being roped in in another dragnet of conspiracy. Take any group of two or three hundred people engaged in any kind of commercial life now and charge them all up together with doing things—well, it is just a difficult situation."

Although the Department of Justice did not finally insist upon a consent decree as a part of the settlement of the suit, a representative of the Department stated to the Court that in the discussions with representatives of defendants relative to such a decree, the Department was particularly interested in four phases of the fertilizer industry.

(1) They felt that the activities of the Superphosphate Association group (charged in the indictment with maintaining an organized exchange of current price lists, reporting to each other concerning deviations therefrom, and making provision for assessment of liquidated damages for failure to make such reports) should be enjoined, and understood that that association had gone out of existence.

(2) They "felt that some adjustment was necessary in connection with the so-called producer-agency contracts which permitted the producer in effect to fix resale prices."

(3) They "thought some adjustment was necessary in the method of determining freight under the so-called port basing point system. A part of the freight under this system is phantom freight and paid by all who purchase fertilizer in a particular area, regardless of distance located from the port."

(4) They "felt that something should be

done to eliminate the arbitrary and artificial zoning system that existed in the industry."

When the War has been won and nations have established a system of world justice and fair dealing, it is hoped that the same conditions can be established between business and government in this country, so that the present dragnet methods of prosecution can be avoided and law-abiding manufacturers can know what the laws are and what their legitimate interpretation definitely is.

R. M. SALTER NAMED CHIEF OF BUREAU OF PLANT INDUSTRY

Secretary Wickard today appointed R. M. Salter chief of the Bureau of Plant Industry, to succeed Dr. E. C. Auchter, recently appointed Administrator of the Agricultural Research Administration, under which the Secretary recently grouped eight research agencies of the Department, including the Bureau of Plant Industry.

Mr. Salter, born in Huntington, Ind., has been active in plant and soil research for 25 years. From 1917 to 1921 he was agronomist and soil chemist at the West Virginia Experiment Station. He then became connected with agronomic work at the Ohio State University and from 1929 to 1940 served as chairman of the Department of Agronomy in charge of crops and soils in the University and the Ohio Agricultural Experiment Station. He was made vice-director of the Ohio Agricultural Experiment Station in 1940 and later that year accepted appointment as director of the North Carolina Agricultural Experiment Station.

He left North Carolina in October, 1941 to head the Bureau of Plant Industry's newly organized Division of Soil and Fertilizer Investigations, comprising the former Divisions of Soil Chemistry and Physics, Fertilizer Research, and Soil Microbiology. Mr. Salter is a Fellow in the American Society of Agronomy, was president in 1936, and for several years has been chairman of a committee on fertilizers.

Dr. R. O. E. Davis, who for several years has been connected with the Department in soil and fertilizer work, has been designated as acting head of the Division of Soil and Fertilizer Investigations.

Dr. M. A. McCall will continue to serve as assistant chief of the Bureau of Plant Industry and head of the Division of Cereal Crops and Diseases.

FEBRUARY SULPHATE OF AMMONIA

Due to the shorter work-month, production of by-product sulphate of ammonia dropped 10.6 per cent from the January figures, according to the U. S. Bureau of Mines. Production of 58,598 tons is higher, however, than February, 1941, and is continuing at somewhat more than 2,000 tons per day. Daily shipments continue to increase, with the result that stocks on hand at the manufacturing plants on February 28th had dropped to 18,300 tons.

	Sulphate of Ammonia Tons	Ammonia Liquor (NH_3 Content) Tons
Production:		
February, 1942	58,598	2,605
January, 1942	65,548	2,904
February, 1941	58,360	2,341
January-February, 1942.	124,146	5,509
January-February, 1941.	123,029	5,005
Shipments:		
February, 1942	61,706	2,950
January, 1942	74,955	3,056
February, 1941	63,960	2,776
Stocks on hand:		
February 28, 1942	18,300	788
January 31, 1942	21,585	896
February 28, 1941	41,928	756
January 31, 1941	47,529	947

BOYD APPOINTED V.-C. AGRONOMIST

Frank E. Boyd has been appointed southern agronomist by the Virginia-Carolina Chemical Corporation and will have his headquarters at Montgomery, Ala. A graduate of the Alabama Polytechnic Institute, Mr. Boyd was for a time a member of the Alabama Experiment Station staff and served in the A. E. F. during the first World War. Since 1926 he has been connected with the Chilean Nitrate Educational Bureau.

Obituary

ERNEST W. WAMPLER

After a career of over 40 years in the fertilizer industry, Ernest W. Wampler, former president of the Miami Fertilizer Company, Dayton, Ohio, died on March 27th. Starting with the Jarecki Chemical Company in Cincinnati, he continued with that organization following its purchase by the Armour Fertilizer Works, serving as branch manager. In 1925 he and C. R. Martin organized the Miami Fertilizer Company at Dayton and he held the position of president until his retirement on January 1, 1941.

March Tag Sales

March fertilizer sales, as indicated by the sale of tax tags, amounted to 1,156,000 tons in the 17 reporting States. This represented a decrease of 22 per cent from March, 1941. However, total sales for the first quarter of the year were 24 per cent greater than for the corresponding period of 1941.

The seasonal peak in most years normally occurs in March, with sales in the month accounting for nearly one-third of the annual total. The picture is abnormal this year due to early buying of fertilizer by the farmers. The decline in March tag sales followed substantial increases in both January and February, but tax tag sales necessarily anticipate shipments of fertilizer.

Sales during March in North Carolina, South Carolina, and Georgia, the three heaviest fertilizer using States, were considerably less than in the same month of 1941. Six of the 12 southern States, however, did show increases over the corresponding month of last year.

In the Midwest larger sales for March were reported in Illinois and Kentucky, but these increases were more than offset by declines in the other three midwestern States. The net result for the month of March was a 22 per cent decline from last year. Aggregate tonnage for January-March in the five midwestern States was 39 per cent greater than during the first quarter of 1941.

FERTILIZER TAX TAG SALES

State	March				January-March			
	1942		1941	1940	1942		1941	1940
	Per Cent of 1941	Tons	Tons	Tons	Per Cent of 1941	Tons	Tons	Tons
Virginia	94	69,852	74,304	79,549	132	226,370	171,473	167.783
N. Carolina	56	184,951	310,558	316,098	144	813,807	564,688	558,312
S. Carolina	54	142,414	265,216	298,265	108	472,139	435,254	444,380
Georgia	71	243,953	343,482	319,616	109	561,745	513,384	478,883
Florida	94	50,460	53,517	53,656	104	211,177	203,905	176,007
Alabama	111	163,600	146,950	199,150	153	416,650	271,850	312,950
Mississippi	79	55,525	70,313	108,675	96	194,440	203,252	196,013
Tennessee	344	35,771	10,410	23,456	198	79,350	40,018	39,682
Arkansas	115	29,750	25,800	36,000	137	100,000	72,800	66 200
Louisiana	118	44,489	37,830	57,825	102	100,436	98,930	102,311
Texas	147	39,453	26,817	43,455	120	84,033	69,797	77,016
Oklahoma	107	2,255	2,110	2,320	74	5,805	7,796	5,173
Total South	78	1,062,473	1,367,307	1,538,065	123	3,265,952	2,653,147	2,624,710
Indiana	54	35,018	65,079	54,225	135	182,586	135,687	113,019
Illinois	107	18,103	16,881	7,164	192	40,293	21,029	12,507
Kentucky	132	26,940	20,348	22,786	144	65,721	45,749	40,111
Missouri	76	12,661	16,670	16,670	134	40,864	30,483	23,888
Kansas	75	614	816	918	18	919	5,033	2,368
Total Midwest	78	93,336	119,794	101,763	139	330,383	237,981	191,893
Grand Total	78	1,155,809	1,487,101	1,639,828	124	3,596,335	2,891,128	2,816,603

FERTILIZER MATERIALS MARKET

NEW YORK

Investigation on Supply of Fertilizer May Be Started. Fish Scrap Ceiling Causes Objections. Shortage Exists in Most Materials.

Exclusive Correspondence to "The American Fertilizer."

NEW YORK, April 7, 1942.

Questions have been raised in Washington regarding the supply of commercial fertilizers available as well as the supply of raw material available for the manufacture of commercial fertilizers, and it is possible that a senatorial committee may be appointed for an investigation.

Fish Scrap

During the week of March 30th, the Office of Price Administration placed a ceiling on fish scrap at $3.00 per ton below the ceiling which had previously been placed on fish meal. Unless sellers of fish scrap are willing to sell considerably under the ceiling, the grinders of this material will be unable to operate as the $3.00 differential would mean a loss on operations.

Nitrate of Soda

There has been no change in the price for April and deliveries are now being made for April as material is allocated.

Sulphate of Ammonia

The demand continues for this material but stocks are low and suppliers are still considerably behind against contract commitments.

Potash

The demand continues with prices unchanged but very little, if any, material is being offered. Deliveries are being made against contract but again suppliers are somewhat behind on deliveries against contract obligations.

Superphosphate

There have been no changes in the price but all available supplies are being used and very few offerings are being made. High test superphosphate continues scarce and deliveries against contracts are considerably behind.

Nitrogenous

The demand for this material has eased off somewhat and there has been a slight reduction in price but supplies are not pressing.

BALTIMORE

Criticism of Ceiling on Fish Scrap and Meal. Organic Material Prices Slightly Lower. Bag Situation More Serious.

Exclusive Correspondence to "The American Fertilizer."

BALTIMORE, April 7, 1942.

The outstanding feature in the fertilizer business during the past two weeks was the announcement of ceiling prices on fish scrap on the basis of $3.00 per ton below fish meal.

Ammoniates.—Due to the lower ceiling on feeding products, ground animal tankage is ruling slightly easier, being in the neighborhood of $6.40 per unit of nitrogen and 10 cents per unit of B.P.L., f.o.b. northern producing points, with ground dried blood on about the same basis.

Nitrogenous Material.—The market on this is also ruling slightly easier, being about $4.00 per unit of nitrogen, f.o.b. Baltimore.

Sulphate of Ammonia.—There is no resale material available, as none of the fertilizer manufacturers will have sufficient tonnage to cover their normal requirements.

Nitrate of Soda.—From present indications it would appear only about one-third of the usual tonnage will be released to fertilizer manufacturers in this section, and this will doubtless result in curtailment in the consumption of nitrate of soda, especially for top dressing. There is no change in the market.

Fish Meal.—The spread between scrap and meal is so low as to make it unattractive to grinders, and it is anticipated that after due investigation the Government will probably widen the margin.

Superphosphate.—There is no change in the market which continues firm at $10.00 per ton, basis 16 per cent for run-of-pile, or $10.50 for flat 16 per cent grade, both in bulk, f.o.b. Baltimore.

Bone Meal.—The demand is practically nil, and the market strictly nominal.

Potash.—There are no re-sale offerings on the market and the situation is generally unchanged.

Bags.—With ceiling on both new and second-hand bags, a majority of the manufacturers have turned to paper bags, while the small mixers are refilling bags furnished by their customers. The war situation in Calcutta makes it problematical as to just what further quantity of burlap will be imported this year.

ATLANTA

No Change in Nitrate of Soda Prices. Deliveries of Sulphate of Ammonia Behind Schedule

Exclusive Correspondence to "The American Fertilizer."

ATLANTA, April 6, 1942.

Nitrate of soda price and allotments have been announced for April, with no change in price at the present time.

Ceiling prices rule on sulphate of ammonia with the demand extremely strong, and no re-sales. Producers are three to four weeks behind in shipments.

Cottonseed Meal.—The 41 per cent protein grade is priced at $36.00, Memphis; $39.50, southeastern mills.

South American Blood and Tankage.—$5.35 ($6.50½ per unit N), c.i.f.

Domestic Nitrogenous.—Some producers now accepting business on the basis of $3.00 ($3.64½ per unit N), f.o.b. western producing points, for summer shipments.

CHARLESTON

Movement of Mixed Goods at the Peak but Slackening Expected Shortly. Little Carry-over of Materials Expected.

Exclusive Correspondence to "The American Fertilizer."

CHARLESTON, April 6, 1942.

The movement of mixed goods continued heavy within the past week, though manufacturers say it may slacken within the next two weeks. It is entirely possible that most manufacturers' stocks will be pretty well cleaned up.

Nitrogenous.—Supplies of this material are fairly scarce. The market is around $3.30 per unit of ammonia ($4.01 per unit N), f.o.b. western points; $3.70 per unit of ammonia ($4.49½ per unit N), ex vessel southeastern ports, prompt if any left.

Blood.—This material is quoted around $5.35 per unit ammonia ($6.50½ per unit N), c.i.f. ports, but this is nominal as freight space is practically unobtainable. Chicago market is $5.80 per unit ammonia ($7.05 per unit N).

Fish Meal.—Supplies of this material are unobtainable.

Cottonseed Meal.—The 8 per cent grade is quoted at $42.00, Atlanta; $36.88, Memphis.

Superphosphate.—There are practically no offerings of this material.

CHICAGO

Higher Prices Cause Lower Demand for Fertilizer Organics. Light Trading in Feed Materials.

Exclusive Correspondence to "The American Fertilizer."

CHICAGO, April 6, 1942.

New developments in the ammoniate market were lacking during the past two weeks. The small tonnage offered was priced higher than most manufacturers would pay, intimating they would get along without additional organics.

Trading in animal feed materials continued light, as only small quantities were placed on the market. The ceiling prices of the finished feeds naturally resulted in mixers accordingly reducing their views on materials.

Nominal prices are as follows: High-grade ground fertilizer tankage, $4.00 to $4.25 ($4.86 to $5.16½ per unit N) and 10 cents; standard grades crushed feeding tankage, $5.30 to $5.50 ($6.44 to $6.68½ per unit N) and 10 cents; blood, $5.50 to $5.60 ($6.68½ to $6.80½ per unit N); dry rendered tankage, $1.12½ to $1.17½ per unit of protein, Chicago basis.

February Superphosphate Production

Superphosphate production in February, according to those acidulators who report to The National Fertilizer Association, was considerably larger than in February, 1941. This was the thirteenth consecutive time that an increase over the corresponding month of the preceding year had been reported. The northern and southern areas both registered a gain of 20 per cent over February, 1941. Total production for the month was seasonally lower than in January.

Production in the January-February period was 24 per cent higher than in the corresponding months of last year, with increases of 24 per cent reported by northern producers and 23 per cent by southern producers.

Stocks of bulk superphosphate were somewhat lower in February. Stocks in base and mixed goods were also moderately below January, contrary to the usual seasonal movement. Total stocks at the month-end were 17 per cent smaller than at the close of February, 1941. This was the tenth consecutive month in which a decline was recorded, in spite of the fact that production at both northern and southern plants continued to increase.

Superphosphate Production, Shipments, and Stocks for February and January-February, 1942 and 1941

Expressed throughout in equivalent tons of 16% A.P.A. Based on reports by acidulators to The National Fertilizer Assn.†

February	United States 1942	United States 1941
Stocks—First of month:		
Bulk superphosphate	951,555	1,083,209
Base & mixed goods	834,557	859,973
Production:		
Bulk superphosphate	390,467	326,146
Base & mixed goods	11,693	8,551
Total Production	402,160	334,697
Other Receipts*	31,409	41,456
Book Adjustments	—1,001	—1,268
Total Supply	2,218,680	2,318,067
Shipments:		
Superphosphate:		
To mixers	156,530	114,124
To other acidulators	69,840	42,471
To consumers, etc.	128,788	91,899
Total Superphosphate	355,158	248,494
Base & mixed goods	227,436	101,849
Total Shipments	582,594	350,343
Stocks—End of month:		
Bulk superphosphate	886,577	1,034,647
Base & mixed goods	749,509	933,077
Total Stocks	1,636,086	1,967,724

Accumulated Production and Shipments for January-February

	United States 1942	United States 1941
Production:		
Bulk superphosphate	812,266	656,915
Base & mixed goods	20,704	16,328
Total Production	832,970	673,243
Shipments:		
Superphosphate:		
To mixers	284,579	226,384
To other acidulators	124,288	77,560
To consumers, etc.	190,458	137,938
Total Superphosphate	599,325	441,882
Base & mixed goods	341,843	140,269
Total Shipments	941,168	582,151

† Represents approximately 85 per cent of total production.
* Includes inter-company transfers.
Base includes wet and/or dry base.

FERTILE SOIL

. . . THANKS TO POTASH!

An important factor in the quality of such crops as cotton and corn is the chemical make-up of the soil. If it contains the proper proportion of potash to other plant-foods high yields of good quality are assured.

Cotton grown on potash plentiful soil matures free from rust and wilt; corn becomes healthier and stronger . . . more resistant to disease and drought.

These two important crops depend upon a fertilizer that includes enough potash to make up for deficiencies in the soil. Fertilizer manufacturers can depend upon SUNSHINE STATE POTASH because of its uniform analysis and careful sizing which makes blending easy.

Higrade Muriate of Potash (62/63% K_2O) also 50% K_2O Grade
Manure Salts 22% K_2O Minimum

UNITED STATES POTASH COMPANY, INCORPORATED

Trade-mark Reg. U. S. Pat. Off.

30 ROCKEFELLER PLAZA, NEW YORK

HIGH-GRADE FERTILIZERS ARE MORE PROFITABLE

(Continued from page 9)

ents. And what did we do? We replaced it with a 5-10-10 which, as Chart A shows, brought its plant nutrients to consumers at a cost well under the level at which we could have furnished them the same plant food in the 4-8-8 mixture.

The question naturally arises as to whether we experienced difficulty in making this change. The answer is that there were many questions asked and there was quite a lot of explaining to do during the first season or two, but in spite of many users having been thoroughly accustomed to the 4-8-8, the change was made and made abruptly. The success of this and similar changes indicates, we believe, the readiness of most of us to follow well-reasoned changes.

Fertilizer users frequently wonder whether they are changing to as satisfactory a mixture when they use higher analysis grades. The answer is fairly simple and positive: first, that crop yields are as high with one as with the other; second, that whether the user is a potato grower applying a large amount of fertilizer on each acre or a grower of corn or wheat or grass using relatively smaller amounts, the returns have been equally good. Another important consideration is that the higher analysis ingredients contain generally as little or less of the factor called "soluble salts" for each unit of plant nutrients furnished. Thus one ton of 4-8-8 usually has more total soluble salts than 1,600 pounds of a 5-10-10, and one ton of 4-16-20 has less potential crop injury factors in it in terms of total salts than two tons of 2-8-10.

May I venture the opinion that if fertilizer consumers have presented to them 20- and 25-unit mixtures in place of the present 15- and 20-unit grades, most of them will make the change provided those presenting the change make the presentation constructive and really try to put such a program across. I am also quite confident that such a change can be made rather abruptly as well as smoothly. I am equally confident that everyone involved will gain directly or indirectly from it.

RELATIVE CONSUMER COST FOR FERTILIZER IN SEVEN CONCENTRATIONS

FROM 15 TO 45 UNITS OF PLANT NUTRIENTS

100 = COST FOR 3 TONS OF 3-6-6

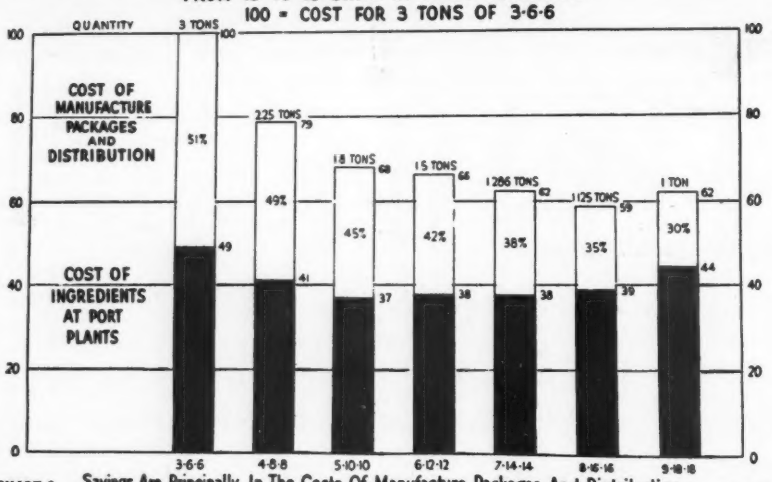


CHART C Savings Are Principally In The Costs Of Manufacture. Packages And Distribution 1942

Southern Agriculturist

15

HUNGRY LITTLE LONDON KIDS SAY "THANK YOU, MR. FARMER"

Photograph supplied by British Food Ministry

Food for Victory . . . The No. 1 Job on Your Farm

Vegetables grown on American farms, dehydrated for safe shipment across the Atlantic, provide a nourishing hot dish for grateful youngsters from London's East End

LOOK at these little faces . . . you can see in their eyes the thanks they give. They're getting good wholesome food now, not all they want, but enough to keep them well and strong.

British children have benefited substantially from food from our farms—from your farm, perhaps. Thanks to our shipments of evaporated and powdered milk for adult use, Britain's supply of fresh milk now goes largely to children. Babies under six months get at least a quart of fresh milk a day; those under six years get a pint a day; those under eighteen get 3½ pints a week.

At least 90% of children under two years are getting free fruit juices, too, from American concentrates. That's enough to help them grow normally. Egg allotments to all have been increased; cheese has been increased; the bacon ration is being maintained.

Food produced by American farmers has made it possible for the British to stand up under blood, sweat, tears and toil. "Cut off American food tomorrow," says a recent visitor to England, "and Great Britain is a thing of the past."

That means just this: no matter how long a man can go on fighting on an empty stomach, there comes a time when his strength gives out. Without American aid the British would have to live chiefly on bread and potatoes. Such a diet would not build strength or resistance.

That is why meeting your goals is the number one job on your farm. In spite of labor scarcity, in spite of restrictions on machinery and supplies, we have got to send food and more food to our allies. And demand is very heavy for oils and fats. We must grow more soy beans, more peanuts, more flax.

The bigger these vital oil-bearing crops—the more milk and dairy products, the more pork, eggs and vegetables—the better the war will be fought; the quicker victory will come.

Food for Victory . . . the Spirit of 1942

This is one of a series of reports from the United States Department of Agriculture published by the Chilean Nitrate Educational Bureau, Inc., in furtherance of the Nation's food production program. Publication of this report in this space does not constitute endorsement by the United States Department of Agriculture of any commercial product.

Buy Defense Bonds and Stamps

HIDDEN HUNGER AND YOU

(Continued from page 7)

come by supplying the soil with the specific chemical which experiment has established as the corrective.

As with plants, so with animals and man; so-called "diseases" may be the outward sign of nutrient deficiencies. We now recognize it is important to normal development and well-being to have in the diet a sufficient amount of calcium and phosphorus in proper ratio, together with Vitamin D. The diet of a full-grown man must provide about 1⅓ ounces of phosphorus and about 5/7 ounce of calcium per month. Over 70 per cent of the ash of the animal body consists of calcium and phosphorus and about 99 per cent of the calcium and 30 per cent of the phosphorus are in the bones and teeth. You all know the relation between rickets and a deficiency of calcium and phosphorus in the diet. It would take me too far afield to attempt to trace the ramifications of the roles of magnesium, chlorine, sulphur, zinc, iron and the other elements in the nutrition and development of the animal body, even if I were fully competent to do so. It is sufficient to our purpose to say that scientists consider that many of the so-called "trace" elements which are essential to plant-life are equally important in human and animal nutrition for the prevention of disease. Iron, of which the adult body contains about ⅕ ounce, is absolutely essential to the formation of red blood corpuscles. Manganese is needed in the process of all animal reproduction, and is more commonly known for its ability to prevent slipped tendons in poultry. Iodine prevents goiter. These are only a few instances which illustrate the influence of these trace elements on the health of men and animals.

You will be interested in some recent "case" histories which follow, illustrating some of these newer discoveries.

Nutritional Anemia

Dr. Ouida Abbott of the Home Economics Department of the Florida State Agricultural Experiment Station travels over that state to teach farmers how to improve their diets. She reports that she used to see hundreds of chalky-faced, dull-looking, listless boys and girls. She wondered why and asked people. The answer invariably was "hookworm." She could not believe this was the answer in all cases. She got busy. With the help of a physician she eventually proved that the cause was not hookworm at all, but nutritional anemia. Malnutrition was pulling the youngsters down. When small amounts of iron and some other minerals were added to the diet, the result was like magic. The listless youngsters bucked up, played and romped as normal children should. Dr. Abbott reported that 75 per cent of the diets in her territory did not include the protective foods—vegetables, fruits, eggs and milk. And more important, she found that many of the local protective foods *did not protect.* Some of you may know the diet habits of the people down there. They consume large amounts of turnip greens. However, these greens, grown locally, failed to provide enough iron and other minerals. Chemical analysis showed that home-grown turnip greens in these areas of Florida contained less than 25 per cent of the iron present in greens from other soils. Here is the interesting point. At about this same time some scientists in Florida were working with so-called "salt-sick" disease among livestock. The cattle were forced to graze for their food. These investigators traced a close relationship between "salt-sick" and deficiency of iron, copper and cobalt in the local soils. Dr. Abbott heard about this. It gave her an idea. Taking the results of the "salt-sick" survey as a basis, she was able to prove that in five Florida

See Page 4

counties, from 52 to 96 per cent of the groups of more than 4,000 children investigated were anemic in those same "salt-sick" counties where the soil was deficient in minerals. Where the soil was rich or adequately supplied, neither cattle nor children showed signs of anemia. "Iron pills" of dried leafy vegetables grown in mineral-rich soils are now being fed to the children in the affected areas. This treatment, however, is merely palliative. The economical and practical way, it seems to me, would be to correct the soil deficiencies.

Now let us *go overseas* for other case histories.

New Zealand, as you know, is famous for its important livestock industry—one of the largest in the world. It is a comparatively young country where you would not expect serious soil depletions to exist. Yet, we learn from reports of the New Zealand Grassland Association that they, too, now recognize many so-called diseases of sheep and cattle as definitely associated with mineral deficiencies in their soils. This unbalanced animal nutrition has increased in late years at a rapid rate and is now of major economic importance.

"Milk fever" of dairy cows and sheep in many districts in New Zealand is associated with a drop in the calcium level of the blood. It has been shown that milk fever occurs when the stock feeds heavily on young, rapidly growing grass having a potash content excessively high in proportion to lime and sodium. In other words, an excess of potash forces the animal to void too much calcium, and this upsets the calcium-phosphorus ratio. Milk fever is prevented by liming the soil or adding burnt lime to the drinking water.

Another condition known as "grass staggers" occurs shortly after calving. Investigation has shown that the condition is caused by a deficiency of magnesium in the blood. Most often "grass staggers" and milk fever occur on the same farms and a relationship has been established between these diseases and an unbalanced ratio in the soil of phosphorus to calcium and magnesium.

New Zealand also reports the presence of nutritional anemia. It is interesting to mention this here because of what was previously said about anemia in Florida. At first they had supposed that lack of iron was causing severe losses among cattle and sheep. The Florida work had shown that copper also had to be used with iron to overcome this type of anemia. This fact suggested to New Zealand investigators that something else besides iron would have to be used to overcome the condition. This hunch turned out to be right. Subsequent investigation proved that the "something else" involved was cobalt, a chemical extremely deficient in their volcanic soils. Cobalt is now used in New Zealand almost exclusively to prevent nutritional anemia. The strange thing about it is that cobalt "hunger" does not affect pigs, horses and rabbits. It is confined to cattle and sheep.

So much for the anemias.

Grass

The quality of meat, eggs, milk and other foods depends upon what animals eat. Better nutritive quality, therefore, starts at the grass roots. Man, too, lives by grass, so to speak. It is grass, the grains included, that gives us most of the essential minerals needed to build up the body and maintain health and vigor.

Rich Pennsylvania farmland.

"Grass is converted by livestock into milk, butter, meat and other nutrients comprising our main diets."

Grass is the perfect food. Very tender grass is rich in vitamins and minerals. It has, on the average, 23 times as much vitamin A as carrots, 22 times as much vitamin B_2 as lettuce, 14 times as much vitamin C as tomatoes and citrus fruit. That grass may be made into a palatable food for man is one of the interesting prospects for the immediate future. Scientists have apparently succeeded in "transmitting the unique properties of grass directly into human nutrition." It is reported that grass culture for this purpose is already an established industry in the Southwest. One of the large breakfast cereal companies is commercializing a process whereby vitamins are extracted from grasses. Cereal grasses—wheat, oats, rye, barley—are planted in well-irrigated fields and

are allowed to grow to the green-shoot stage. The grass is cut when it is about one to two inches long or before it has developed any joints; then it is dried quickly under intense heat and ground into a fine powder. The dehydrated grass retains its rich store of vitamins intact and is sold as such for animal feed purposes; and is prepared for human consumption in tablet form.

Pastures Provide Cheap Feed

Why is it, then, that despite this knowledge our pastures are allowed to become depleted? This seems strange. It should be obvious that selling meat and milk from the farm also sells fertility—the farmer's real capital. Let us consider some of the values reported for fertilized and non-treated pastures.

The average cow eats the equivalent of about 2 tons of dry pasture grass during the grazing season, which in terms of soil fertility, equals 115 pounds of nitrogen, 26 pounds of phosphoric acid, 93 pounds of potash, and 37 pounds of lime. Assuming that the manure is conserved, the loss in fertility will still be about 60 to 70 pounds of nitrogen, 13 pounds of phosphoric acid and about 35 pounds of potash, or as much plant food as in about ½ ton of a 6-1-3 fertilizer. Years of cropping pastures with little or no replenishment of plant food have created serious deficiencies in fields that used to be fertile.

Lowered fertility reduces yields and nutritional quality. Analyses of grasses grown on fertile and non-fertile fields support this statement:

Dr. R. H. Lush, formerly at the Louisiana Experiment Station, has reported that fertile alluvial-land pasture in Louisiana produced about 5,068 pounds of total digestible nutrients per acre which is the feed equivalent of 93 bushels of ear corn, 14½ tons of corn and soybean silage, and the equivalent in protein of 3,272 pounds of 41 per cent cottonseed meal. During the same period, unfertilized but properly seeded flatwoods pasture 50 miles away produced only about ⅓ as much dry matter, ¼ as much total digestible nutrients, ⅕ as much calcium and only 1/12 as much phosphorus per acre.

The Virginia Station reports that one fertilized pasture under test contained as much as 39 per cent more crude protein and 47 per cent more phosphorus than unfertilized pastures.

The Missouri Station reports that 15 pounds of soybeans hay grown on limed soil were equal in nutritional value to 27 pounds of soybean hay grown on untreated soil—or an increase in value of 44 per cent.

The Florida Station reports that it has some soils areas so dangerously low in lime that dairy cows in milk suffer from what is called "stiffs," while dry cows do not show this "disease."

These are only a few typical results which could be multiplied indefinitely.

Samples of pasture herbage collected this past summer at my own farm in Baltimore County and analyzed by Dr. G. L. Clark of the University of Illinois reveal how easy and practical it is to improve the mineral content. His spectroscopic analysis shows the following comparison of the herbage on superphosphated permanent pastures and on untreated pastures:

	Per cent
Improved Pasture	
Manganese	0.012
Phosphorus	0.504
Calcium	0.204
	Per cent
Not Improved Pasture	
Manganese	0.010
Phosphorus	0.230
Calcium	0.192

The phosphorus content on the improved pastures almost doubled.

Nutritional Quality Helps Win Races

It is proper to mention at this point what has already become a classic example of the interrelationship between soil fertility, nutritional quality of pasture herbage, and stamina in thoroughbreds. I refer to the story of the E. B. McLean race horses as related by Dr. Robert L. Humphrey before the Horse and Mule Association of America. It has to do with conditions and results which since then have been frequently confirmed in many states. Briefly, the highlights of the story are these: two famous stallions, Colin and The Porter, were being blamed for the poor showing of their colts on the race track. Dr. Humphrey was called in to examine The Porter's colts which seemed to be suffering from bad legs and soft joints. Blood tests from all the colts and some mares on the farm showed without exception that all the animals were suffering from calcium and phosphorus deficiency. The clue led them to suspect the same deficiencies might exist in the soil. A heavy application of stable manure and superphosphate was applied to the pastures. Three months later the blood tests showed a significant increase of the minerals. The results on the race-tracks thereafter were startling. The year following the mineral fertilization, the McLean stable won double the number of races and its earnings were four times as great. Two years later the

showing was even better, the stable winning sixty races worth $234,640. Dr. Humphrey pointed out that, when the supply of nutritional minerals was adequate in the soil, it was reflected in the pasture feed and in the animals. Later when the fertilizer program was dropped, mineral deficiencies returned. Losses on the race-track returned, too.

Suggestions on What To Do

I have tried to outline some of the more important considerations in the group of problems involved in nutritional deficiencies. What can we do about them? I confess the problems are complex and perhaps no one simple solution is possible. I believe many of our present agricultural practices will have to be changed fundamentally and our sights must be raised. In all future thinking on these problems, the first and major emphasis will have to be given to human well-being in its relation to a prosperous, healthy, and sufficient nation.

We should have a far more intimate knowledge of the extent to which the necessary mineral nutrients are available in all the important soil types in each section of the country. Soil surveys setting forth this relationship will have to be made not only to enable us to know what crops can be grown abundantly, but also to make sure that such crops will contain these elements. In all countries, each large population group practically depends for most of its vegetable and animal foods on locally grown crops. Hence, the importance of knowing what essential mineral nutrients the soils in each such community can furnish. If it is not practical and economical to replenish deficient minerals in such soils by commercial fertilizers or other means, then it were best that such areas should be abandoned for food producing purposes.

Instead of hunting all over the world for new substitute plants of lower feeding value to be grown on soils known to be depleted, it seems to me that it is wiser and sounder to restore the fertility of the land to the level where it will grow, for example, fine crops of alfalfa and red clover.

Instead of the all-too-common attitude which regards poor, depleted land as good only for pasture, we should develop an attitude which measures the economic value of good grassland in terms of butterfat and beef and milk of high nutritional quality. We shall have to insist that pasture soils should have a high fertility level in phosphorus, calcium, potash and the minor elements. The feeding value of grass is in direct proportion to the amount of these mineral nutrients.

We should have more laboratories working in close cooperation with the Plant, Soil and Nutritional Laboratory established by the U. S. Department of Agriculture at Cornell University.

The public should be taught by proper agencies to appreciate nutritional quality in foodstuffs and to give preference to those known to be grown under conditions favoring maximum nutritional quality. Housewives and others entrusted with the preparation of food should be taught the best methods of cooking and preserving it for the human diet, that will retain intact the highest percentage of natural minerals and vitamins.

Conclusion

In the last analysis the problem of human and livestock nutrition resolves itself into a problem of improving the methods of crop production, that is, food production to create a higher degree of public health. Up till now, nearly everyone has considered this problem from the point of view of how to increase yields. Agricultural research has succeeded in teaching us how to increase yields. The fertilizer industry has made many valuable contributions to the art and science of increasing yields. But, as I said at the beginning, *yield is not enough.* We must now also think in terms of nutritional quality. It is the responsibility of all agencies—federal, state and private—now engaged in the fundamentally important industry of food production and food preparation, to work closely together for the one great purpose—a nation of vigorous, healthy, properly fed people.

CUSHMAN APPOINTED OPA SECTION CHIEF

On April 1st, George Cushman was appointed Chief of the Agricultural Chemicals Section of OPA with offices on the 27th floor of the Baltimore Trust Building, Baltimore (Telephone: Plaza 8170). Mr. Cushman has been serving as consultant in this section since March 1st. As operating head of the Long Island Produce & Fertilizer Co., Riverhead, N. Y., and as a director of the National Fertilizer Association, Mr. Cushman is entirely familiar with the problems of the farmer, of the individual fertilizer manufacturer, and of the industry as a whole.

BUYERS' GUIDE

A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

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Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

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Barrett Division, The, Allied Chemical & Dye Corp., New York City.
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AMMONIA LIQUOR
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Bagpak, Inc., New York City.
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BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.

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Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
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Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
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BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
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Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City.

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Armour Fertilizer Works, Atlanta, Ga.
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Baker & Bro., H. J., New York City.
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Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

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BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.

CHEMICALS—Continued
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Dickerson Co., The, Philadelphia, Pa.
Phosphate Mining Co., The, New York City.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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DISINTEGRATORS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Co., Columbus, Ohio
International Minerals & Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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MACHINERY—Power Transmission
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.
Duriron Co., Inc., The, Dayton, Ohio.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Charleston Mining Co., Inc., Richmond, Va.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting
Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
Union Potash & Chemical Co., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

ROUGH AMMONIATES
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

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SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Hayward Company, The, New York City.

SCREENS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Taylor, Henry L., Wilmington, N. C.

SULPHURIC ACID—Continued
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland, Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Sackett & Sons, Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
DuPont de Nemours & Co., E. I., Wilmington, Del.

UREA-AMMONIA LIQUOR
DuPont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROW (See Carts)

ZINC SULPHATE
Tennessee Corporation, Atlanta, Ga.

ALPHABETICAL LIST OF ADVERTISERS

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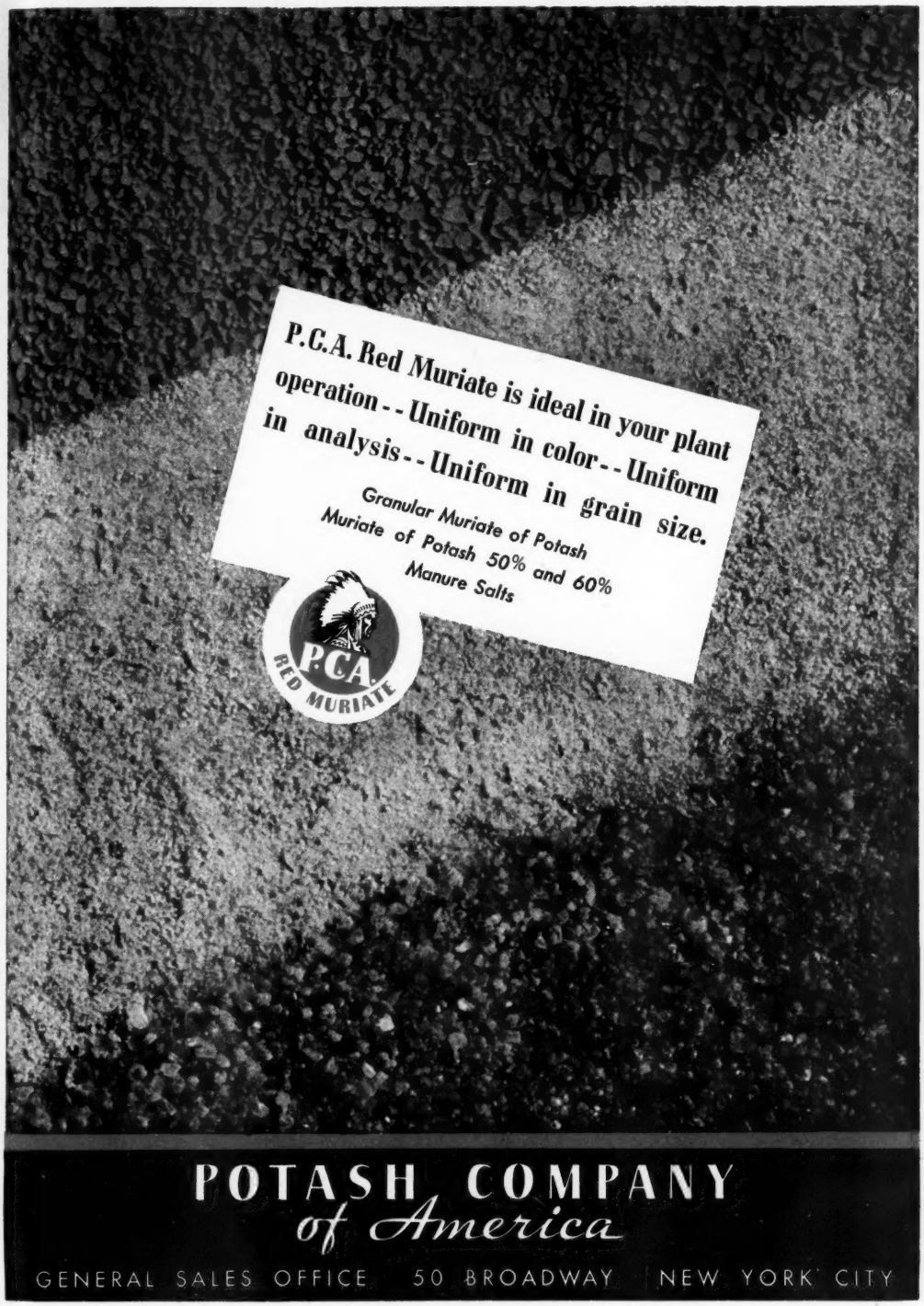
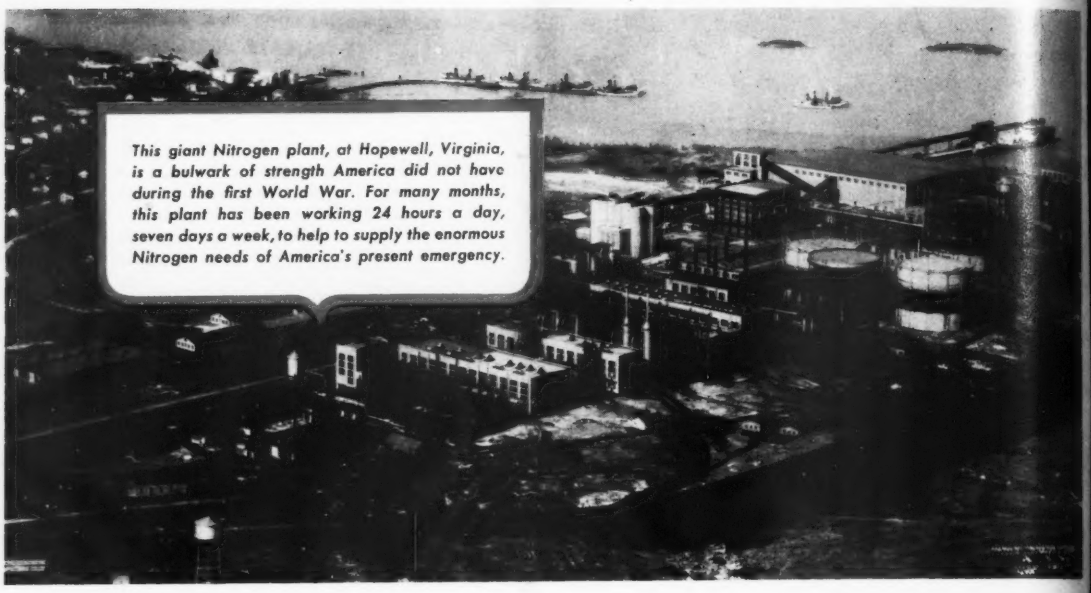

P.C.A. Red Muriate is ideal in your plant operation--Uniform in color--Uniform in analysis--Uniform in grain size.
Granular Muriate of Potash
Muriate of Potash 50% and 60%
Manure Salts
P.C.A.
RED MURIATE
POTASH COMPANY
of America
GENERAL SALES OFFICE 50 BROADWAY NEW YORK CITY



NITROGEN goes to WAR

ESSENTIAL to the production of both food and munitions, Nitrogen is a vital need of America at War.

Without fertilizer Nitrogen, the great "Food for Freedom" program would be impossible. Fertilizers increase the efficiency of farm labor . . . help each hour of work to return a better harvest. And, the American farmer is faced with a labor shortage today.

Yet, munitions come first in a national emergency. And, Nitrogen—that builds the roots, stalks, stems and leaves of crops—is also needed in the manufacture of guns, ammunition, ships, planes and tanks.

When the extra demands of World War I found America almost wholly dependent upon imported Nitrogen, supplies became scarce and prices soared. But, the price remains low today due to 25 years of great progress in the development of domestic Nitrogen.

During that period, the production of American-made Nitrogen was increased 1,300% and its price was cut in half. This helped to quadruple the fertilizer use of Nitrogen . . . helped to double its peacetime industrial use . . . helped to provide the vital protection that is so important today.

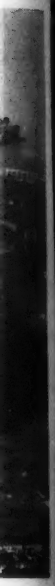
THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET
NEW YORK, N. Y.

HOPEWELL, VA. RALEIGH, N. C. COLUMBIA, S. C.
ATLANTA, GA. MONTGOMERY, ALA. MEMPHIS, TENN. SAN FRANCISCO, CAL.

Headquarters for American-made Nitrogen

Barrett NITROGEN

BARRETT NITROGEN SOLUTIONS ★ DOMESTIC SULPHATE OF AMMONIA ★ 'ARCADIAN, THE AMERICAN NITRATE OF SOD



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